CAMELIA 8M

8 MEGAPIXEL DIGITAL CAMERA

User guide

Phone +33 (0) 1 49 75 96 00 - Fax +33 (0) 1 49 75 96 01
www.atmel-grenoble.com

CAMELIA PACKAGE CONTENTS :

Depending on the selected configuration, a CAMELIA package may include :

CAMELIA camera

FGT frame grabber board

''Power supply'' cable + ''RS232'' cable

''Data & Sync'' cable.

''COMMCAM'' software.

FGT software.

documentation

SYSTEM REQUIREMENTS :

+24V(0.6A) power supply

Lens : NIKON or other Fmount lens

Lightning control (shutter/chopper or pulsed lightning).

GETTING STARTED :

connect the camera to one of the computer serial ports (COM1 or COM2) by using the RS232 cable

power on the camera

install ''COMMCAM'' software in your computer. (see "COMMCAM User Guide")

install FGT frame grabber board and FGT software in your computer. (see "FGT Frame Grabber User Manual")

run the system

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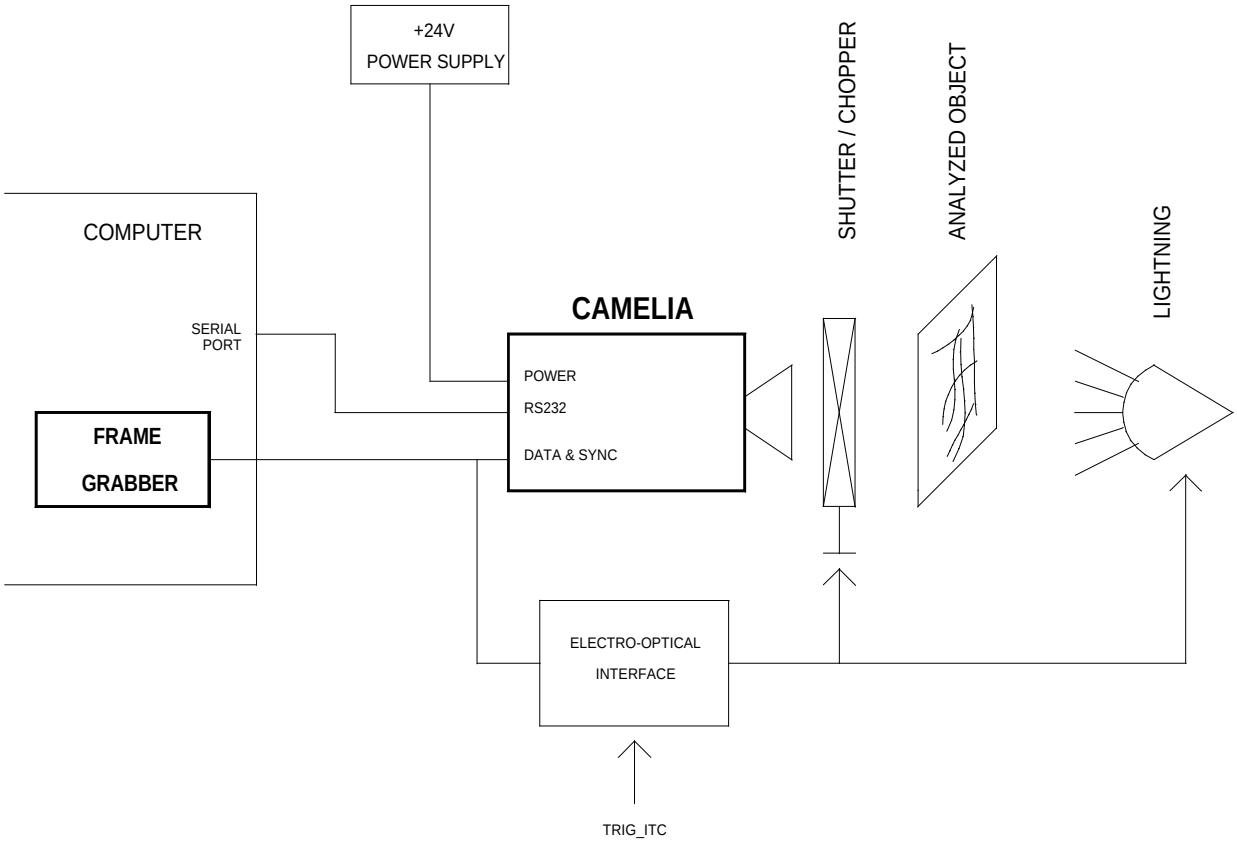
1. IMAGING SYSTEM DESCRIPTION



- CAMELIA camera is powered by a +24V power supply.
- CAMELIA camera is configured through the serial port of the computer.
- CAMELIA camera sends digital video to the FGT frame grabber.
- As CAMELIA 's CCD is a full frame sensor, you must use either pulsed lightning or a chopper/shutter in front of the camera in order to have incident lightning on the CCD only during integration time. You must design an electro-optical interface to drive camera, shutter/chopper or lightning by using the "SHUTTER" signal delivered by the camera. If required, the system can send an external trigger or external ITC (integration time control signal) to the camera.

2. CAMELIA 8M CAMERA

2.1 CCD

- image format : 35.0mm(V) x 23.0mm(H)
- active pixels :

Mode (set via RS232)	Image size (H x V)
No binning	2300 x 3500
2x2 pixel binning	1150 x 1750
4x4 pixel binning	574 x 875

- readout register along the small side of the image area. (vertical image)
- pixel geometry :
  - 10µm(V) x 10µm(H).
  - aperture ratio : 100%.
- anti-blooming by clocking.

2.2 TIMING MODES

3 timing modes are available (set via RS232) :

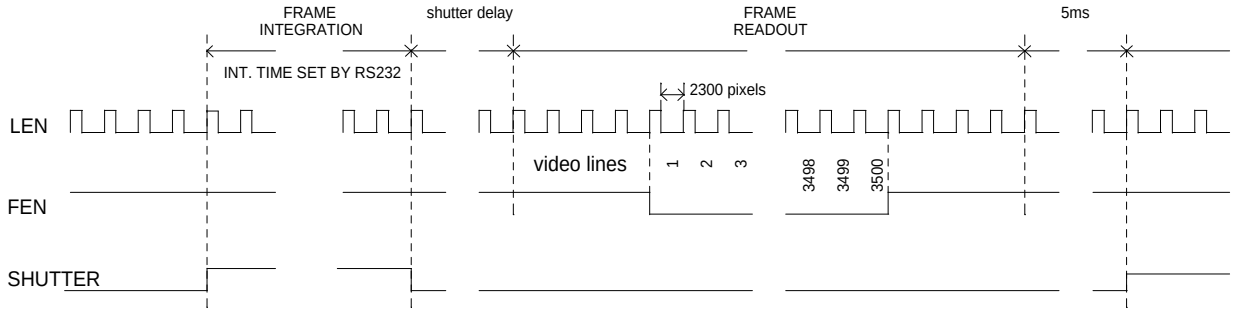
- continuous : the camera delivers frames continuously :
  - frame N+1 integration starts as soon as frame N readout is completed.
  - integration time is set by RS232
- operation with external trigger : integration start is controlled by the user from the external signal TRIG :
  - the rising edge of TRIG activates the start of the frame integration. This rising edge is synchronized by the camera with a precision of 110µs
  - integration time is set by RS232
  - note : TRIG signal period must be greater than integration time plus frame readout time.
- operation with "integration time control" : integration is fully controlled by the user from the external signal ITC :
  - the falling edge of ITC activates the start of the frame integration. This falling edge is synchronized by the camera with a precision of 110µs
  - the rising edge of ITC activates the stop of the frame integration. This rising edge is synchronized by the camera with a precision of 110µs
  - note : ITC signal period must be greater than integration time (defined by ITC low) plus frame readout time.

2x2 and 4x4 pixel binning is possible to enable previewing modes.

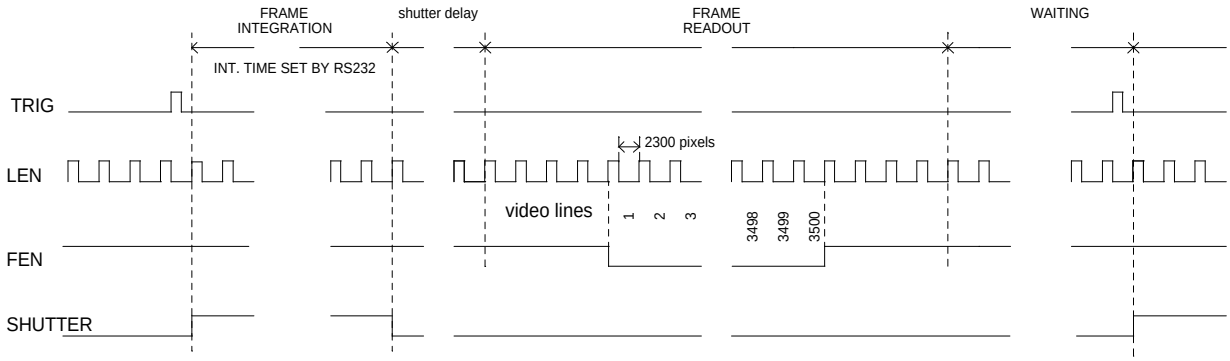
Data rate is :

- pixel clock : 25 MHz
- frame readout time :
  - normal mode : 370ms
  - 2x2 pixel binning : 200ms.
  - 4x4 pixel binning : 110ms.

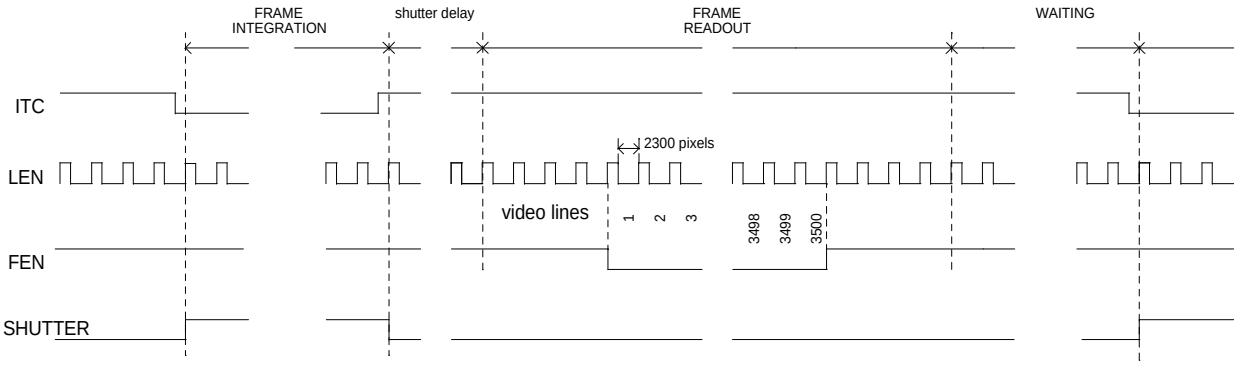
Timing diagram (for continuous operation) :



Timing diagram (for operation with "external trigger") :

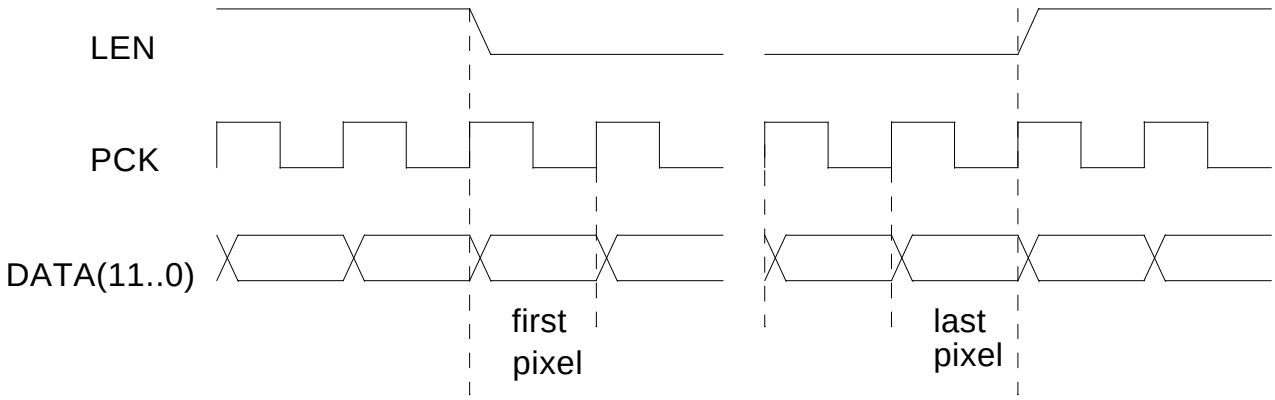


Timing diagram (for operation with "integration time control") :



2.3 LINE READOUT TIMING.

Duty cycle of the PCK is 50%.
Rising and falling edges : 1,5 nsec.



2.4 ANTI-BLOOMING BY CLOCKING

Anti-blooming can be activated or inhibited (set via RS232) :

- ◊ anti-blooming OFF : this position is recommended if anti-blooming is not required for the application.
- ◊ anti-blooming ON : anti-blooming is activated.

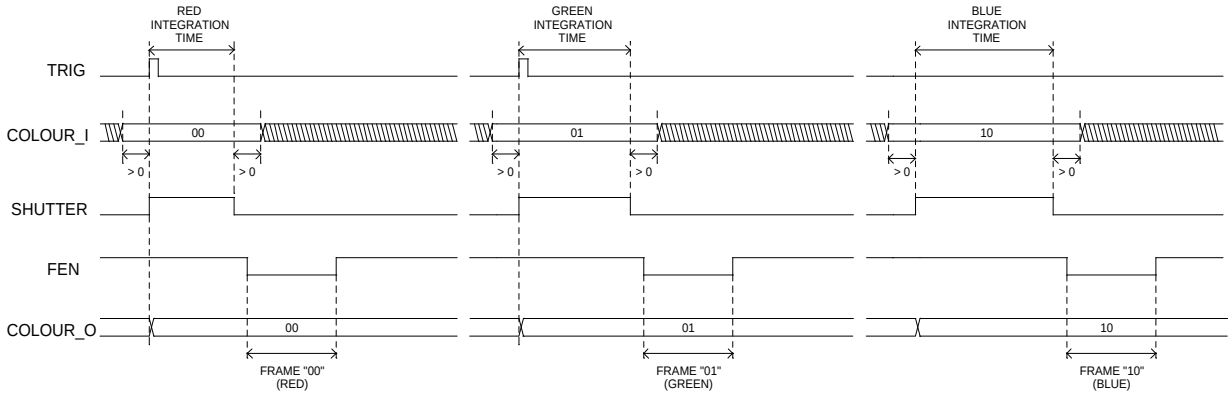
2.5 COLOR OPERATION

In ‘’3 shot color’’ mode, each image is made of 3 frames : red, green, blue :

- ◊ the camera must be operated either in ‘’external trigger’’ mode or in ‘’integration time control’’ mode.
- ◊ for each image, the user selects the color of the next frame by setting COLOUR_I1 and COLOUR_I2 input signals. COLOUR_I1, _I2 must be valid in the time period between TRIG signal rising edge (or ITC signal falling edge) and SHUTTER signal falling edge. (see timing there after)
- ◊ color definition is :

COLOUR_I2	COLOUR_I1	Frame Color
0	0	Red
0	1	Green
1	0	Blue

- ◊ integration time can be adjusted differently for each color (set via RS232). This allows to have a better signal to noise ratio for the color with the lowest sensitivity (i.e. the blue)
- ◊ each frame requires a TRIG_ITC signal.
- ◊ CAMELIA 8M camera synchronizes COLOUR_I1, _I2 with the rest of the timing and sends COLOUR_O1, _O2 to FGT frame grabber.



2.6 ROIs

Regions of interest.

CAMELIA 8M can operate in a “multi ROI” mode allowing masking of regions of the image and thus increasing frame rate by a reduced readout time.

User defines up to 5 windows to be masked. In addition he specifies starting and ending addresses for each window.

Time reduction : about 92 µsec per masked line.

Two steps :

- Enter the number of regions masked by the CommCam command : F=X (X=0 to 5)
- Enter the list of starting and ending addresses by the CommCam command : Y=ssss/eeee/ssss/eeee/…/eeee/

For example : how to mask 2 regions of 500 lines each, one on the top of image, the second on the bottom, 1x1 pixel binning :

CommCam commands : F=2 then Y=0/500/3000/3500/

In this example readout time will be reduced of 1000 lines equivalent to 92 msec.

2.7 ELECTRICAL INTERFACES

2.7.1 POWER SUPPLY

Voltage	Current
+24V Min : +20V ; Max : +28V	0.6A

2.7.2 DIGITAL I/O

SYMBOL	I/O	DEFINITION	LEVEL
TRIG_ITC	I	Timing control : TRIG_ITC is either an external trigger or "integration time control" depending on the timing mode configured via RS232. operation with external trigger : TRIG_ITC = TRIG operation with "integration time control" : TRIG_ITC = ITC TRIG_ITC is synchronized by the camera line clock (jitter : 110 µs)	LVDS
COLOUR_I(1..0)	I	Color selection of the next frame (in color mode) : - "00" : red - "01" : green - "10" : blue	LVDS
S(11..0)	O	Digital video output : 12 bits	LVDS
FEN		Frame enable : - FEN = 0 : frame data valid : active lines - FEN = 1 : frame data not valid	LVDS
LEN	O	Line enable : - LEN = 0 : line data valid : active pixels - LEN = 1 : line data not valid	LVDS
PCK	O	Pixel clock	LVDS
COLOUR_O(1..0)	O	Color identification of the current frame (in color mode) : - "00" : red - "01" : green - "10" : blue.	LVDS
SHUTTER	O	shutter open/close : - during integration : shutter = 1 - during readout : shutter = 0 delay between the falling edge of shutter and the start of readout : - 4 positions : 1ms, 5ms, 10ms, 20ms. (set via RS232)	LVDS

Note : LVDS drivers / receivers :

- LVDS : Low Voltage differential Signal. (EIA 644 standard). All digital I/Os are differential : (signal+, signal-). Specifications are given for signal+.
- manufacturer NS
- driver : DS90C031TM (SO16 package)
- receiver : DS90C032TM (SO16 package)

2.8 CAMERA CONFIGURATION VIA RS232 INTERFACE

Camera configuration is set by RS232 interface, using COMMCAM software (see "COMMCAM user guide").

Users who wishes to develop their own configuration software will read the "Camera RS232 interface user guide".

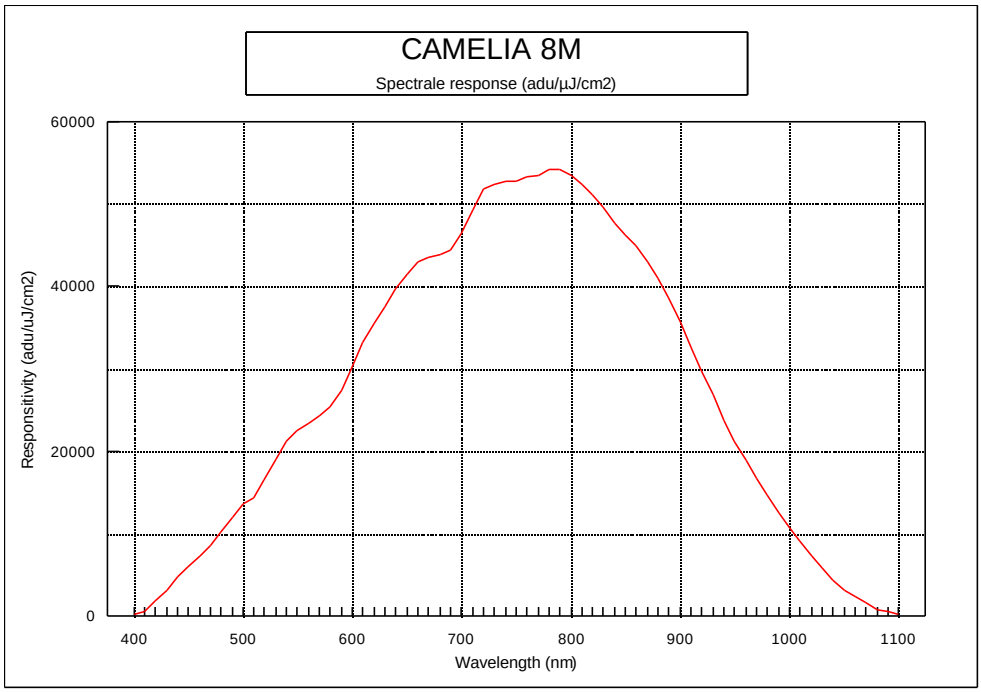
2.9 ELECTRO-OPTICAL PERFORMANCE

- Conditions :
  - ◊ frame integration time : 40ms
  - ◊ camera operating free air temperature : 25°C

- Performance :

Parameter	Symbol	Typical Value	Unit
Full scale value see note 2	VPE	4095	adu
Temporal noise σ see note 3	VN	2.7	adu
Dark signal non uniformity σ see note 4	DSNU	2	adu
Dynamic range see note 5	DY	1500	
Responsitivity see note 6	R	50	adu/(lux.s)
Resolution - horizontal contrast transfer function at Nyquist - vertical contrast transfer function at Nyquist see note 7	 CTFh CTFv	 40% 40%	
Anti-blooming - over illumination capability See note 8		8x	

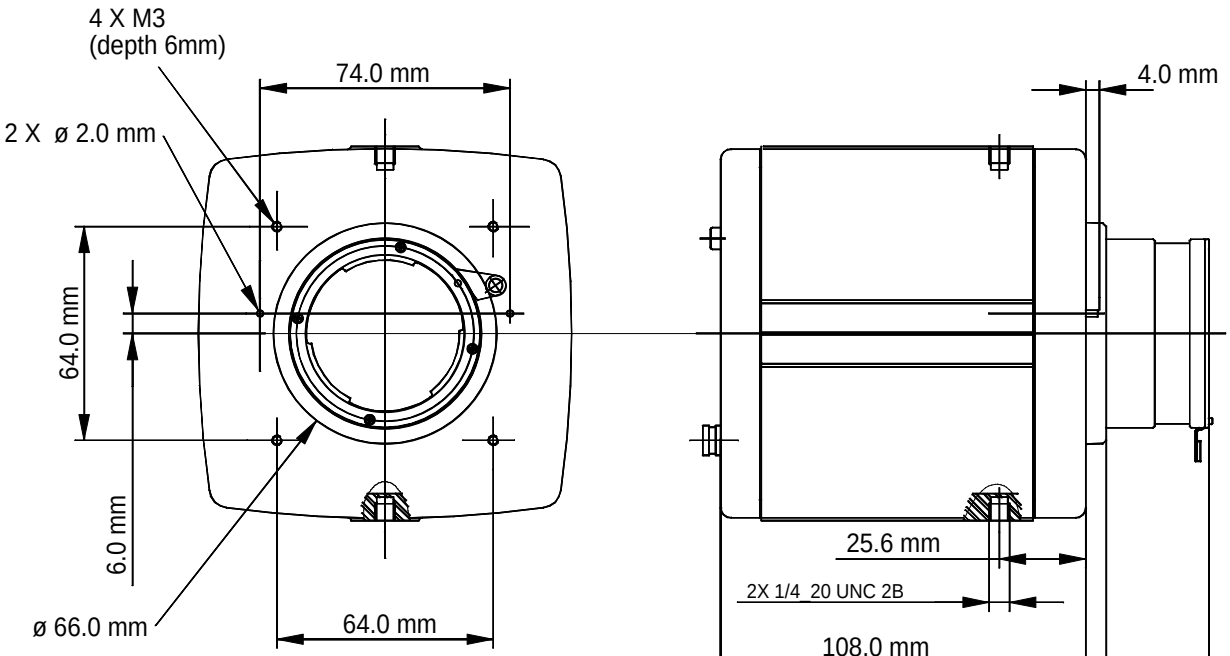
- note 1 : adu : arbitrary digital unit : 12 bit = 4095 adu or gray levels.
- note 2 : full scale value VPE : maximum digital video signal
- note 3 : temporal noise VN : r.m.s value in darkness. Measured by substracting 2 images pixel to pixel
- note 4 : dark signal non uniformity : r.m.s value. Excludes blemishes.
- note 5 : dynamic range DY :
  - ◊ DY = VPE / VN
- note 6 : responsivity :
  - ◊ conditions :
    - CDS gain = 1x.
    - Light source 3200K, BG38 2mm
    - lens aperture : F/4.
    - lux on the scene taking into account : scene reflectance 80%, lens transmission 80%
- note 7 : resolution :
  - ◊ conditions :
    - light source 3200K, BG38 2mm.
    - VIDEO = 2000 adu, CDS gain = 1x.
- note 8 :
  - ◊ anti-blooming ON
  - ◊ integration time = 100ms.



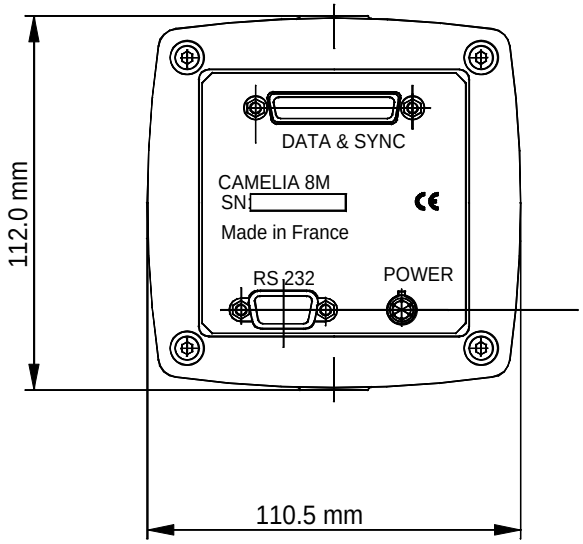
Note : µJ/cm^2 measured on the CCD chip.

2.10 GEOMETRICAL SPECIFICATIONS

FRONT PANEL



REAR PANEL



- Weight : 1400g.

2.11 ENVIRONMENTAL REQUIREMENTS

- operating temperature : 0°C / +50°C
- storage temperature : -20°C / 70°C
- operating humidity : < 80% at +35°C
- vibration : 2g sinusoidal, from 10Hz to 55Hz.

2.12 IMAGE GRADE

2.12.1 TEST CONDITIONS

- Room temperature
- Illumination conditions : 3200K Halogen lamp with BG38 Infrared filter and f/11 aperture
- Integration time = 100 ms
- Test under illumination at 50% of saturation level

2.12.2 DEFINITIONS

- Defect sizes

- Blemish : 1 x 1 defect.
- Cluster : blemish grouping of not more than a given number of adjacent defects :
  1 x 1 < **cluster 1** size ≤ 2 x 2
  2 x 2 < **cluster 2** size ≤ 5 x 5
- Column : one-pixel-wide column with more than 7 contiguous defective pixels.
- Defect separation : Defects are separated by no less than "**D min**" pixels in any direction.
- Note : all defects are non contiguous.

- Defects in darkness
  - blemish or cluster : pixel(s) whose signal deviate(s) more than 160 adus from the average output signal
  - Column : column whose signal deviates more than 16 adus from the average output signal

- Defects under illumination
  - blemish or cluster : pixel(s) which deviate(s) by more than ±20% from the average output signal
  - column : column which deviates by more than 10 % from the average output signal

	Blemishes		Cluster 1		Cluster 2		Column	
Grade	**Total**	**D min**	**Total**	**D min**	**Total**	**D min**	**Total**	**D min**
E	≤ 500	3	≤ 30	50	≤ 6	100	≤ 5	150
H	≤ 300	3	≤ 10	50	0	-	0	-

Without any specification, E grade will be used on Camelia cameras.

3. CONNECTORS AND CABLES

3.1 ''DATA AND SYNC'' CABLE

- On camera side :
  - 50 points HIROSE connector : HIROSE DX10A-50S.
  - mating connector on cable side : HIROSE DX40-50P ; shell : HIROSE DX50-CV1.
  - Pin-out :

Pin n°	Signal		Pin n°	Signal
1	PCK+		26	LEN+
2	PCK-		27	LEN-
3	FEN+		28	COLOUR_O1+ **(1)**
4	FEN-		29	COLOUR_O1-**(1)**
5	COLOUR_O2+ **(1)**		30	GROUND
6	COLOUR_O2-**(1)**		31	GROUND
7	PDATA0+		32	PDATA1+
8	PDATA0-		33	PDATA1-
9	PDATA2+		34	PDATA3+
10	PDATA2-		35	PDATA3-
11	PDATA4+		36	PDATA5+
12	PDATA4-		37	PDATA5-
13	PDATA6+		38	PDATA7+
14	PDATA6-		39	PDATA7-
15	PDATA8+		40	PDATA9+
16	PDATA8-		41	PDATA9-
17	PDATA10+		42	PDATA11+
18	PDATA10-		43	PDATA11-
19	GROUND		44	NC
20	GROUND		45	NC
21	SHUTTER+		46	TRIG_ITC+
22	SHUTTER-		47	TRIG_ITC-
23	COLOUR_I1+**(1)**		48	COLOUR_I2+**(1)**
24	COLOUR_I1-**(1)**		49	COLOUR_I2-**(1)**
25	NC		50	NC

Notes :

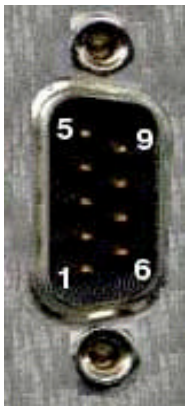
- NC : not connected.
- **(1) : grey cells : not used for CAMELIA COLOR : must be left unconnected**
- a "Data + Sync" cable is provided with FGT Frame grabber, including a part to be connected to the electro-optical interface, and the second one to the "FGT" frame grabber : see "FGT Frame Grabber User Manual".

- On frame grabber side :
  - 50 points MDR 3M connector : 10150-6000EL.
  - Pin-out compatible to frame grabber FGT.

3.2 ’POWER SUPPLY’’ CABLE

Hirose 6 pins male
HR10A-7R-6P

Pin Number At camera output	Signal	Pin Number At end of power supply cable
5	+24V	1
6	+24V	2
	NC	3
	NC	4
	NC	5
1	GROUND	6
2	GROUND	7
	NC	8
	NC	9



SUBD9 male

- notes :
  - ◊ NC : not connected.
  - ◊ A "power supply " cable is provided with FGT Frame grabber.

3.3 ‘’RS232’’ CABLE

- On camera Dsub 9pins.
- On computer side Dsub9 female, pin out compatible with computer serial port
- note : pin out is the same on camera side and on computer side.

Pin Number At camera output	Signal
1	NC
2	RX
3	TX
4	NC
5	GROUND
6	NC
7	TRS
8	CTS
9	NC

- notes :
  - ◊ NC : not connected.
  - ◊ A "RS232 " cable is provided with FGT Frame grabber.

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For further information please contact :

Atmel-Grenoble – 2, Allée Maryse Bastié – Z.I. d'Orlytech - 91781 WISSOUS Cedex - FRANCE -
Phone +33 (0)1 49 75 96 00 - Fax +33 (0) 1 49 75 96 01.

Internet : http://www.atmel-grenoble.com